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DIAGNOSTIC PROCEDURES USING DIRECT INJECTION OF GASEOUS HYPERPOLARIZED ^{129}XE AND ASSOCIATED SYSTEMS AND PRODUCTS

Abstract of the Disclosure

A method of screening for pulmonary embolism uses gaseous phase polarized ^{129}Xe which is injected directly into the vasculature of a subject. The gaseous ^{129}Xe can be delivered in a controlled manner such that the gas substantially dissolves into the vasculature proximate to the injection site. Alternatively, the gas can be injected such that it remains as a gas in the bloodstream for a period of time (such as about 8-29 seconds). The injectable formulation of polarized ^{129}Xe gas is presented in small quantities of (preferably isotopically enriched) hyperpolarized ^{129}Xe and can provide high-quality vasculature MRI images or NMR spectroscopic signals with clinically useful signal resolution or intensity. One method injects the polarized ^{129}Xe as a gas into a vein and also directs another quantity of polarized gas into the subject via inhalation. In this embodiment, the perfusion uptake allows arterial signal information and the injection (venous side) allows venous signal information. The dual delivery is used to generate a combined introduction path with a more complete image signal of both the arterial and venous side of the pulmonary vasculature. In this NMR imaging method, the pulmonary embolism screening method can use the same NMR chest coil for the excitation and detection of the ^{129}Xe signals. The direct injection of small quantities of gas at particular sites along the vasculature targets specific target regions to provide increased signal intensity NMR images. The disclosure also includes related methods directed to other diagnostic vasculature regions physiological and conditions. Associated delivery and dispensing systems and methods, containers, and quantitative formulations of the polarized gas are also described.